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"FOR the ophthalmic professions the need for inviting and up-to-the-minute offices is urgent. A growing visual consciousness by the public means an increased practice *for the professional man who is equipped to assume his rightful share.*

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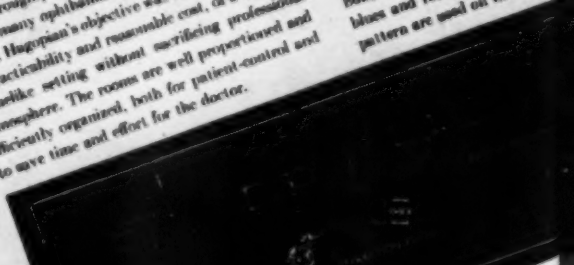
to the left. To eliminate the usual [illegible] rack, Mr. Hagopian indicates a small [illegible] clothes closet just inside the room.

Careful grouping of furniture affords privacy for individual patients as well as bring friends and relatives with them. The ture is made of laminated ash, finished buff, with upholstery of corduroy in blues and reds. Gray-blue rugs with patterns are used on the floor.



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The reception [illegible] green, the ceil[ing] provided by [illegible] tures and a [illegible] The office

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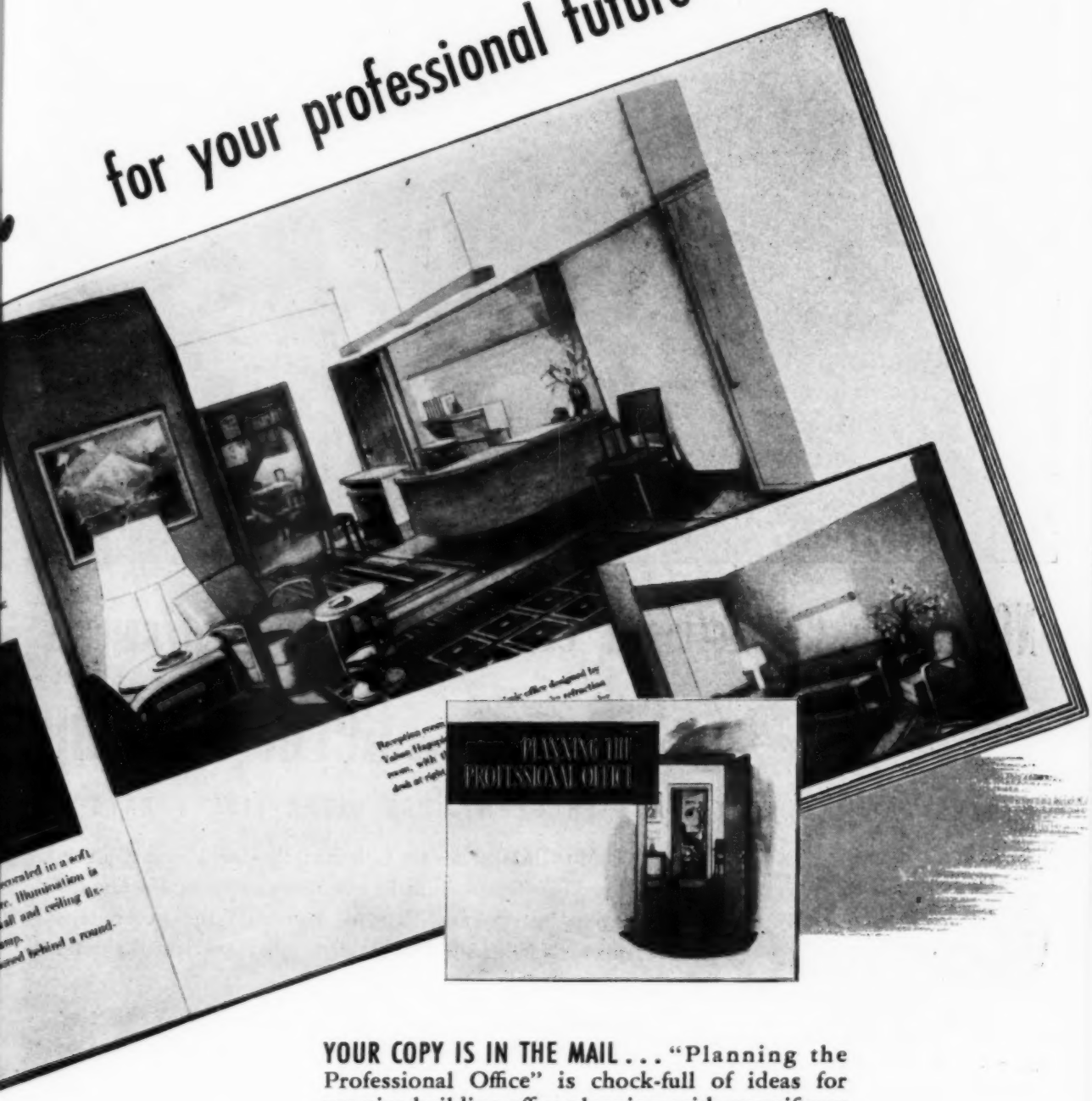

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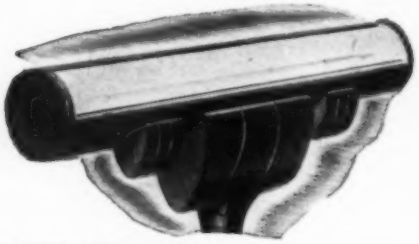

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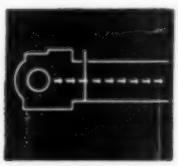
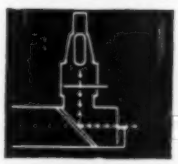


Lights *behind* targets—vital in providing clear definition with light evenly diffused. Control of this light is independent for each eye—a helpful feature in training.



Removable light towers for observing patients' eyes. The lights in these towers also make possible constant light adaptation. Slots receive targets for *near point testing and training* —valuable for training accommodative responses.

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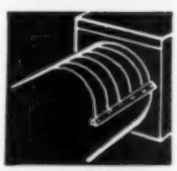
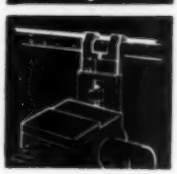


Target slots calibrated in quarter diopters, making possible *instant changes in the stimulus to accommodation.* Changing targets from infinity slot to one of the other positions is equivalent to adding plus or minus lenses.



Base in and base out scales provide quick, easily-read, *accurate measurements* for infinity and at near. Base up and base down readings easily taken as target tubes are lowered and raised. Break and recovery points can be quickly determined.

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Vol. 23 APRIL, 1946 No. 4

REDUCTION OF REFLECTIONS*

Robert C. Graham†
Dayton, Ohio

Of all the technical advances to come out of this war, probably the most significant, optically, is the coating of lenses with reflection-reducing films. Now that coating has been made available to the profession, an appraisal of it is in order, for at present it has both limitations and important uses.

This development had its beginning as far back as 1892 when H. Dennis Taylor, a lens designer of England, observed that the iridescent tarnish which appeared on certain old camera lenses did not reduce the light they transmitted, but increased it instead. The thin film on these optical surfaces reduced reflections and increased the transmitted light by the amount of reduction of the reflections. The metal oxides had been leached from the surface, leaving a thin layer of high silica glass of low density and hence low index of refraction.

The physical conditions which produce zero reflection of monochromatic light are two. The film must equal in optical thickness one-quarter of a wave length of the incident light, and the refractive index of the film must be the geometric mean between the indices of the first and second media. Under the most frequently encountered conditions (air to glass) the index of the intervening film should equal the square root of the index of the glass, and the film should be four millionths of an inch thick. The more nearly these conditions are satisfied, the more completely are reflections damped.

The damping is caused by destructive interference occurring at the two surfaces of the low index film and, in accordance with the law of

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*Read before the Twenty-second Annual Meeting of the American Academy of Optometry, on December 12, 1946, at Columbus, Ohio. For publication in the April, 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. The Univis Lens Company. Fellow of American Academy of Optometry.

conservation of energy, the reduction in reflected energy is added to the transmitted beam.

Taylor developed methods of artificially tarnishing lenses, but the reduction in reflection was slight because the index of the film was not low enough for many glasses and the proper thickness was not appreciated. Other methods of approximating the requisite conditions were developed later until, prior to the recent war, reflections were reduced by leaching lens surfaces with acids or their vapors, by coating with various stearate films, and by whirling lenses so as to spread a thin layer of viscous fluid of low index over the surface by centrifugal force. Some of these produced relatively durable surfaces, some relatively efficient, but none were both.

Since 1938 Strong, whose work was done at the California Institute of Technology, and Cartwright and Turner, whose major work

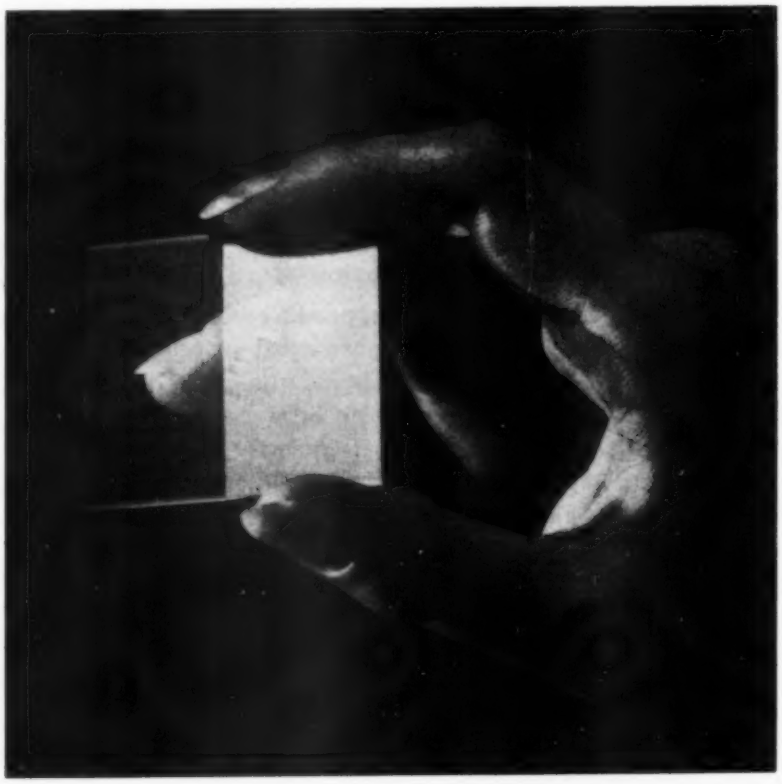

Illustration 1. Square of glass, half of which has been coated with magnesium fluoride to reduce reflections and increase transparency.

was done at the Massachusetts Institute of Technology, have developed a process which combines the maximum of efficiency with the greatest durability. This process, as utilized on optics for the armed forces of our nation, consists of depositing a thin film of magnesium fluoride on optical surfaces in high vacuum and under considerable heat. The difference this produces is shown in Illustration 1. The hand is holding a square of glass, half of which has been filmed.

Lenses to be filmed or coated are treated with a detergent solution, then cleaned long and rigorously, so that no trace of foreign material or oxide remains on the surface. They are then racked in the top of a bell jar and heated to 400+ degrees Fahrenheit while the bell-chamber is exhausted to an extreme vacuum of $4x10^{-6}$ (less than 1 part of air in 100,000,000 remains). This is accomplished by means of mechanical vacuum pumps and a high-speed oil diffusion pump in series. After a protracted period under these conditions, the glass has de-gassed, and its raw substance is exposed. At this point pure magnesium fluoride, held in a crucible in the bottom of the bell jar, is heated by tungsten filaments of such high incandescence that they cannot be viewed by the unprotected eye. Under this heat and high vacuum, the magnesium fluoride vaporizes, and a molecular spray is deposited upon the exposed under-

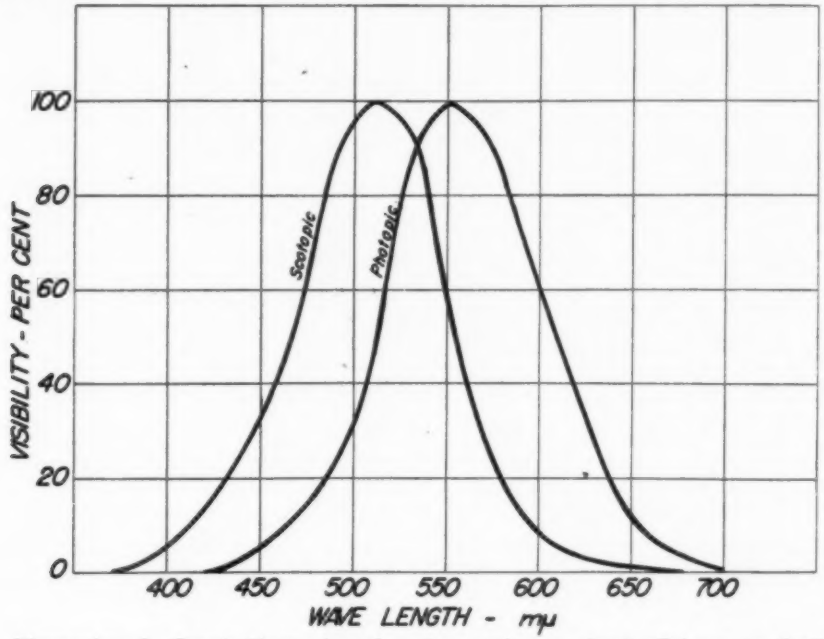

Illustration 2. Graph illustrating that the maximum visual efficiency in daylight lies at a wave length of 554 millimicrons (in the yellow-greens) after Troland.

surface of the lenses. The technician, using a small fluorescent light source, judges the thickness of the film as it accumulates on the lenses by observing reflections from the surface of a monitor lens. As the deposition begins, the usual bright, white reflections from the lenses begin to dim, and turn to a straw color. Then, growing dimmer all the time, they go through a succession of yellows, reds, and reddish blues until, when they reach a specific purplish tint, the evaporation is stopped. At this point reflections are dimmed for all wave lengths, but most completely dimmed for yellow (the quarter-wavelength condition is exactly fulfilled for yellow of wave length 555 milli-microns, less perfectly satisfied as the wave lengths of the other colors of the spectrum differ from that of yellow). The slightly greater reflections of wave lengths at the two ends of the spectrum—the reds and violets—when blended produce the purplish tinge characteristic of the residual reflections from coated lenses. This is the condition of maximum reduction of reflections under ordinary daylight. It is also very close to the condition of maximum transmission of the rays used most efficiently in daylight seeing, as Figure 2 illustrates. After completion of the deposition, the lenses are returned slowly to room temperature. The entire operation takes place in a laboratory in which conditions of temperature and relative humidity are controlled, and the air is Precipitron-cleaned. Illustration 3 shows such a laboratory.

The result is a film almost exactly four millionths of an inch thick which, when protected in optical instruments, is as permanent as the glass. On crown glass of index 1.52 the amount of light-loss at each surface is reduced by a factor of 3. The reduction is not greater because magnesium fluoride has too high an index to perfectly satisfy the square root relationship and because, in heterogeneous daylight, the quarter-wavelength condition cannot be satisfied for all wave lengths.

When light, travelling in air, impinges on the polished surface of crown glass of index 1.52, the loss is 4.2 per cent at each surface. Coating with magnesium fluoride reduces this loss to 1.3 per cent. In an optical system made up of many surfaces, the cumulative saving in light is considerable. In a regular binocular consisting of ten optical surfaces, the following differences prevail:

	Uncoated	Coated
Percentage of light absorbed by glass	12	12
Percentage lost by reflections	33	10
Percentage of light transmitted	55	78

In systems with a greater number of surfaces, the gain is even more striking.

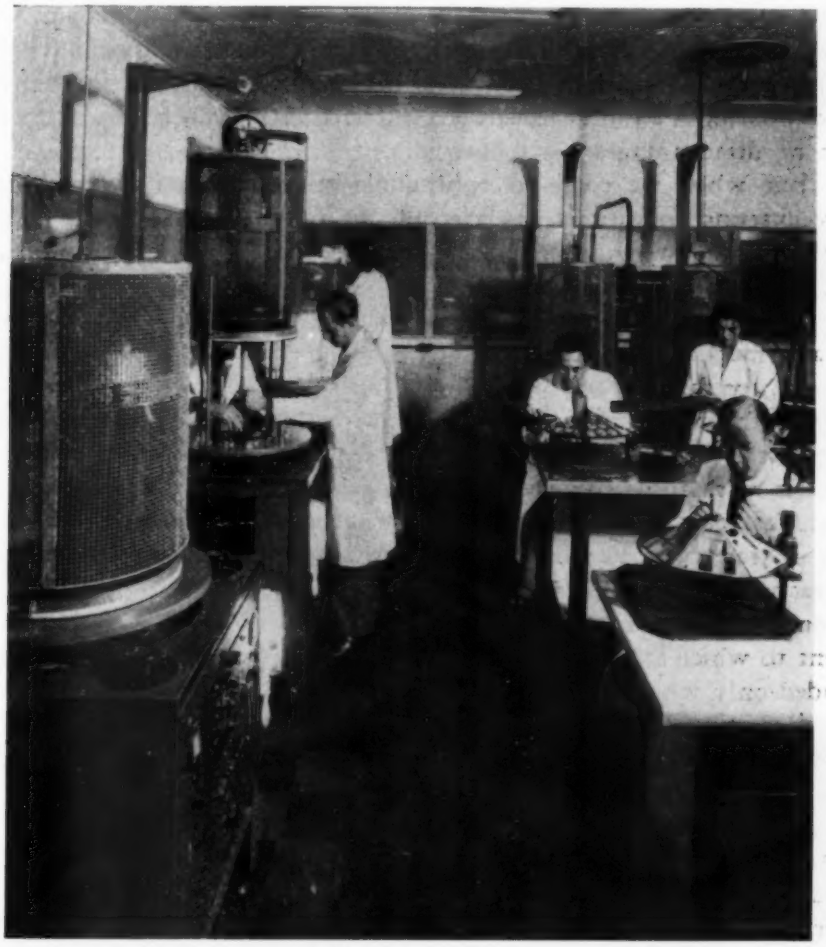

Illustration 3. Part of a coating laboratory.

The result is, in bright daylight, a reduction of ghost images due to interface reflections, and an increase in contrast and detail. And in dim illumination the conservation of light often makes an optical system useful when, before coating, it would not have transmitted enough light for seeing. The tremendous value of this in extending, both at dusk and at dawn, the period of usefulness of photographic, observation and gun-fire-control systems, can be appreciated. As a result, during this war

coating became mandatory for practically every optical system used by our fighting men. The creating of laboratories to treat the many millions of optical surfaces required was one of the production phenomena of the war just passed. Procurement of the high-vacuum equipment was even permitted to compete with that of high-vacuum equipment for the production of Uranium 235, used in atomic bombs. In instrument optics, coating is an unqualified success, contributing much improvement, with no disadvantages.

But when we come to ophthalmic optics we find different and more exacting conditions. As a result, we cannot, in this stage of the development of the science, expect a repetition of the almost one hundred per cent acceptance found in instrument optics. For ophthalmic use, the coat must be rugged indeed, for it is exposed to repeated cleaning and much abrasion. The reduction of reflections is only about fifty per cent, for the incidence of the light varies greatly, so that the quarter-wavelength condition is not always entirely satisfied, even for yellow light. Scratches on a coated surface are more visible, for the light they reflect is more apparent against a dimly-reflecting, coated surface than it would be against a brightly-reflecting, uncoated one. Furthermore, the gain in transmission, which is so important in a multi-surface system, is practically meaningless in a two-surface lens in which light loss is seldom a problem. Hence the coating of spectacles is of value only to the extent to which it can reduce reflections. And, at present, can be recommended only when reflections are a problem.

Reflections from glasses into the eyes of the wearer occur with everyone who wears them. But it cannot be said to constitute a serious problem until the intensity of the reflections exceeds the tolerance of the patient. The intensity of reflections is highest in prescriptions of considerable power, or when the wearer is in such a position that a window or bright source is behind and to the side. The tolerance of reflections will be lowest in neurasthenics and hyper-critical patients. The result is a fair, though not yet accurately determined, proportion of patients who are consciously annoyed by reflections from their glasses and who are greatly relieved when these are substantially reduced.

This does not mean that the great body of patients who have learned to ignore reflections from their glasses would not welcome a reduction of the ghost images and the veil of haze just as one, unconscious of a continuing noise, is relieved when the noise stops. But when coating has been available only for a limited time, a definite assertion to this effect cannot be made.

Reflections from glasses can do more than annoy the wearer. They can, and often do, conceal the eyes of the wearer from anyone looking at him. This is detrimental enough in daily personal contacts when the audience consists of one or a few. But to ministers, teachers, and all who wear glasses when appearing before groups of people, it is a serious impediment. Their expressions are masked, and the specular glare, coming and going as the speaker turns, is a disturbing thing to all the audience. Coating will considerably reduce such masking of the eyes. Illustration 4 shows what can be accomplished

Illustration 4. The subject has one lens coated, one uncoated to indicate how coating inhibits the reflection which otherwise hides the eyes.

In summary, it may be said that the coating available today through ophthalmic supply laboratories is durable, if not permanent, and reduces reflections substantially, although it does not extinguish them or make the glasses invisible. Coating is a new and important development which has reached a state of real usefulness, but not of perfection. As such, its judicious employment will increase the ways by which the profession serves and satisfies its patients.

THE PHYSICAL AND CHEMICAL PROPERTIES OF PLASTIC CONTACT LENSES*

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For centuries the ophthalmic professions and industries lived and developed in a world governed by glass. The expression "As smooth as glass", became a byword for a highly polished surface. It was only logical then, that upon the conception of a contact lens, created to give vision to patients having keratoconus, irregular or scarred corneas, that the industry turned to glass. A glass contact lens was made with excellent optical qualities, and occasionally, a good sclera physical fit.

However, a number of difficulties presented themselves that made glass unsuitable for the widespread acceptance of contact lenses, as the technique of prescribing these has progressed today. Psychologically, the danger of breakage, in the eye as well as in handling, was always a possibility. Chemically, glass deteriorated under the action of the lacrymal fluids, becoming rough and irritating to the eye tissues. Thirdly, its workability was such to make it unfavorable for the precision custom-made lenses that many feel are necessary for a successful contact lens fitting.

At about this time the plastic industries developed a more suitable material that could be used for contact lenses. It could be readily molded, formed and fashioned into variable compound curvatures of an eye and adjusted by slight grinding and polishing methods, to a high degree of perfection. Being clear and transparent, it offered the possibilities of a lens surface comparable to that of glass. These plastics are totally inert to body fluids, weak acids, and alkalines, and in the writer's judgment unquestionably surpass glass as a medium to be worn against the eye tissues.

Since plastics are light and durable, they offer considerable resistance to breakage; therefore, in contact lenses, the only advantage that glass still held over plastics, was in the grinding and polishing of the optical portion of the lens. Since plastic surfaces are considerably softer than

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that of glass, it took years to develop a method of grinding and polishing a precision optical surface of relatively short radii. We have now perfected this problem. However, careful attention must be given a precision polished plastic lens surface, as it readily becomes scratched. Though these scratches, if kept at a minimum, offer no appreciable effect to vision, as the lacrymal fluids continually keep them filled.

We in optometry, as a profession are well acquainted with the production, workability, and functions of glass. However, since plastics are new in an optical sense, I would like to illustrate a few of their unique characteristics. Three all plastic contact lenses may be placed in the hand and appear identical! The chemical properties of these lenses may also be similar; however, each may differ radically in physical properties, due to their method of manufacture. One lens may be manufactured by the "casting" method. The second, by the "forming" process, and the third, by the molding of fine granulations of powder under heat and pressure, known as the "compression" method.

In the casting method, a liquid known as the monomer undergoes a series of chemical changes, and under proper heat and control solidifies to the desired form of the dies used. This may be in the shape of flat sheeting, round rods, tubes, or in the shape of the exact curvature of the eye itself. The molecular structure of the plastic becomes fixed to this original cast shape.

This plastic may then be heated at temperatures usually from 212° F. to 250° F. at which it becomes soft and pliable, and then can be reformed and cooled to obtain its new shape. However, upon the reapplication of heat, the plastic slowly reverts back to assume its original cast form. This is termed, "plastic memory." As an example, should the plastic be cast in the form of sheeting, this sheet can be heated to its softening temperature, and formed in to the compound curvatures of a contact lens. A lens, thus formed in this manner, is continually under tension and strain, and should this lens come in contact with temperatures approximating that of its softening point, their plastic memory releases this tension and the lens loses its identity as a lens and reverts to the original sheet form.

It has been clinically proven to the writer's satisfaction that a contact lens, cast to the accurate curvatures of the replica of an individual eye, maintains a finer degree of accuracy and in those cases requiring slight grinding and polishing adjustments, these operations can be done without danger of warpage or distortion to adjacent curvatures: as is

the case when a lens had been formed and the curvatures held under continual tension and strains.

The compression method, by means of heat and steel dies welds finely powdered granulations of plastic into the curvatures of a contact lens. This being the original form, it fixes the plastic memory to these curvatures. However, this method does not lend itself to the production of a precision custom-made type of lens since many individual expensive highly polished dies would be required. It is most adaptable for the trial and error type of contact lens, as an unlimited number of identical lenses can be made from the same dies.

The difficulty encountered in the compression molding of a precision optical surface is that unless perfect dies and highly accurate controls of heat, pressure and chilling are maintained the surface will exhibit an "orange peel" effect, under diffused light. This the writer believes to be an imperfect lens surface for the physiological optical system of the eye.

SUMMARY

To summarize, this writer feels that the following are the basic essentials for a successful fitting contact lens.

(1) The plastic used must be chemically inert to the lacrymal fluids, the liquid lens, and the eye tissues.

(2) In our clinical investigations we feel the plastic should be cast to the original scleral curvatures of the replica of an eye, thus fixing the "plastic memory" to these curvatures eliminating tension and strains, and maintaining this accuracy at temperatures approximating the softening point of the plastic, as an example, boiling water.

(3) The corneal, or optical portion of the lens, both and concave and convex, must be precision polished surfaces, free of aberrations and irregularities.

ON PRIMARY GLAUCOMA*

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FOREWORD

This manuscript is a revision of the original presented in the September, 1942, issue of this Journal. A considerable amount of new material has been added.

In this presentation, an attempt is made to reveal the etiology of primary glaucoma.

In previous papers [1 2 50 51 52 53], it was shown that many cases of primary glaucoma can be definitely assisted and controlled (provided they have not progressed beyond the stage of help) merely by the avoidance of darkness. After sleeping in a lighted room from three to six months, in about 90 per cent of the cases, the condition is definitely checked, and darkness no longer affects those who previously could not sleep in darkness without ill effects, such as early morning and nocturnal headaches, choking feeling during the night, and other symptoms of primary glaucoma. About 10 per cent must continue sleeping in a lighted room.

Relief may be obtained in one to three days.

Primary glaucoma will not be found in night workers.

GLAUCOMA

In previous papers, considerable clinical and experimental data were submitted [1 2] relating to the complex mechanism involving primary glaucoma.

Evidence points to the fact that darkness is the primary *contributing* factor in its causation, and the prevention of exposure to darkness appears to be the sole step in the prevention and definite control of this condition.

Even though glaucoma is more common in hot countries than in cold, it is generally found that it occurs more frequently during the winter months, especially in the acute cases. During winter, the nights are longer, and the usual person is apt to go to bed much earlier than in the summer months. Hence they are exposed to darkness for longer periods. In India, it is most frequent in June and July when solar radia-

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tion is at a minimum.[3] These points appear to stress that darkness is a highly important factor in the etiology of primary glaucoma.

Blood pressure does not appear to have any effect on intraocular pressure. This was brought out in a previous paper.[1] It has been shown that in poisoning by quinine or the barbiturates, the ocular tension *falls* in spite of a *rise* in blood pressure.[4] In diabetic coma where the loss of tension may be very profound, the intraocular pressure is independent of the height of the blood pressure. According to Sallmann and Kahler, in cases of cerebral diplegia, the intraocular pressure is lower on the paralyzed side even though the blood pressure is higher.[5]

It does not seem that arteriosclerosis of itself has any etiologic bearing on the occurrence of primary glaucoma. In the January, 1940, issue of the COLUMBIA OPTOMETRIST, Pascal points out that in an examination of over 3000 glaucoma cases, Weinstein found 56.2 per cent in men, and 43.8 per cent in women.[5a] Weinstein attributed this difference to the fact that arteriosclerosis is more common in men than in women. According to Weinstein, arteriosclerosis has an important etiologic bearing on the occurrence of primary glaucoma. In truth, it seems that arteriosclerosis has no etiologic influence because, from the writer's observations, the symptoms of the very early stages of primary glaucoma usually occur in the late thirties and early forties, long before arteriosclerosis has a chance to manifest itself. If arteriosclerosis is a factor, why does the avoidance of darkness give almost immediate relief?

If primary glaucoma is allowed to go on without taking any therapeutic or prophylactic steps, the walls of the intraocular vessels will become sclerosed while they are in the dilated state. The tone of the vessels, at this stage, will be very seriously impaired with the result that relief will be almost an impossibility.

On the other hand, in working with physicians, a number of my patients, after being entirely relieved of all of their symptoms, were found to have high blood pressure and arteriosclerosis, in some cases to a very marked extent. Furthermore, all of my readers have examined very many arteriosclerotic patients with no symptoms whatever of primary glaucoma. Cases are also seen in practice where the fundus vessels reveal a definite arteriosclerosis without any symptoms of primary glaucoma. Some cases revealed a very marked "sausage" effect caused by a marked pressure of an arteriosclerosed retinal artery upon a vein without causing any ocular hypertension or symptoms of glaucoma. A few of these cases have been followed up for a period of about ten years.

It is also interesting to add that arteriosclerosis does not occur to

the same extent all over the body. The fundus may appear to be devoid of any arteriosclerosis, and yet very many of the larger systemic arteries may reveal marked arteriosclerotic changes, and vice versa.

The writer has advanced arguments in previous papers [1 2] tending to support the contention that primary glaucoma is not due to drainage interference. There is further clinical evidence that lends strong support to this point.

It has been shown that peripheral synechiae usually occur at a late stage, and that they are more commonly partial, or are *absent altogether*.[6] This absence has been verified by Priestly Smith (1879) and has been seen clinically. Salzmann (1914-15), who made the first observations gonioscopically, found the angle free in four cases of secondary traumatic glaucoma, and partially closed in three cases of congestive and one case of simple glaucoma. Troncoso (1925-1935) reported on a series of 87 cases. Among 26 eyes with acute congestive glaucoma, the angle was open in 26%, closed in 26%, and partially closed in 46%; among 8 eyes with chronic congestive glaucoma, the angle was open in 25%, closed in 50%, and partially closed in 25%. In 34 cases of chronic simple glaucoma, the angle was open in 58.8%, closed in 5.8% and partially closed in 38.2%. In six eyes with simple glaucoma, the angle was partly closed in 50%, and completely closed in 50%. In cases of secondary glaucoma, the angle was open in 62%, closed in 23% and partially closed in 15%. Werner (1932) observed 39 out of 49 eyes with simple glaucoma having an open angle. Barkan, Boyle and Maisler (1936) found sclerosis of the trabeculae and blockage with pigment common, and concluded that while narrowing of the angle may be an early phenomenon, its blockage by adhesions occurs only at a *late* stage.[6]

Duke-Elder[8] states therefore that an angle closed by peripheral synechiae is common *after* an attack of congestive glaucoma, *but that in chronic glaucoma the angle is usually open in the early stages and frequently remains so for a considerable time thereafter.*

The size of the pupil does not appear to have any effect whatever on the intraocular pressure. This fact is supported by ample evidence in a previous paper.[1] Primary glaucoma is no more frequent in those having large pupils than in those having small pupils. The pupil *constricts* in sleep, even under the influence of atropine, [39 40] and yet attacks of primary glaucoma come on especially during the night.[1]

On waking from sleep or anesthesia, the pupils dilate to their normal size. It is interesting to note that this pupillary reaction is not evi-

dent in the new born.[39] According to Bartels (1904) and Bach (1908), it can be produced after the first few days of life. According to Pfister (1898), it does not develop fully until about the age of six months.[39]

Feigenbaum has demonstrated that dark adaptation causes increased tension in blind and seeing eyes, occurring indifferently in aniridia, after an iridectomy, and with pilocarpine or atropine.[32] This has also been observed by Brückner (1922), Puscariu, Cherchez and Nitzulescu (1925).[46]

In a case of tabetic *miosis* with an Argyll Robertson pupil *without synechiae*, Terson (1925) found no enlargement of the pupil in the crises of acute glaucoma.[7]

The pupil dilates after an attack of glaucoma, and not before.

A frequent occurrence in glaucomatous eyes is a deposit of pigment in the meshes of the pectinate ligament. (Levinsohn, 1908-22; Koeppe, 1916-20; Schieck, 1918; Gradle, 1921; Barkan, Boyle and Maisler, 1936). *However, pigment deposits of this nature are a constant occurrence in senile eyes*, and are found in copious formation in cases of diabetes, pigmentary degeneration of the retina and retinal detachments, *without affecting the tension* (Trantas, 1935).[9] According to Duke-Elder [9], *the deposition of pigment is a concurrent manifestation of glaucoma rather than its cause*. In a previous paper,[2] it was shown that ocular hypertension is surprisingly frequent in cases of pigmentary degeneration of the retina. The probable cause advanced by the writer is proliferation of neuroglia within the eyeball. This is substantiated by sufficient clinical evidence.[2] Furthermore, it was shown that drainage interference is a *late manifestation* of glaucoma and therefore cannot be regarded as a cause.

To show further that deposition of pigment does not appear to affect intraocular tension, it is interesting to note that in *hypotony, there is a heaping of pigmentary epithelium on the inner surface of the choroid* (Collins, 1917).[10]

In two previous papers, [1,2], it was shown that in primary glaucoma the tension is highest during the night and the very early morning hours, and lowest in the late afternoon. It is interesting to note that Hagen (1925), Raeder (1925) and Dominguez (1929) have found the opposite to occur in occasional cases.[11] Duke-Elder[13] also found this to occur in cases of retinal detachment, that is the tension being *lowest in the early morning hours*, and *highest in the late afternoon!* This evidence appears to support the writer's theory on the etiology of primary glaucoma.

It was brought out previously[1,2] that light causes constriction, and darkness dilation of the intraocular vessels, particularly those of the choroid. An attempt will be made to show through what medium light and dark appear to affect the respective constriction and dilation of the choroidal vessels.

From the evidence at hand, it seems that the pressure controlling mechanism of the eyeball appears to originate in the chemical anomalies of the regenerated visual purple in darkness,* and will occur only if contact with the retinal epithelium be maintained.[21]

Oguchi's disease,[22] a congenital and stationary form of night blindness first described by Oguchi (1907) in Japan from which country most cases have been reported, appears to lend some evidence that the bleaching and regeneration of the visual purple causes the respective constriction and dilation of the choroidal vessels. Ordinarily in this disease, the posterior region, and sometimes the entire fundus is of a grey color which is probably due to a layer of abnormal tissue between the cones and pigment epithelium. After some hours in the dark, the grey color is replaced by the normal red appearance. In dim illumination, night blindness exists until several hours have been spent in the dark, when vision slowly improves. It is to be noted that after some hours in the dark, the fundus assumes a normal red color simultaneously with the improvement of dark adaptation. It seems likely that the *regeneration* of the visual purple is closely related to the *dilation* of the choroidal vessels which is made evident by the fact that the fundus assumes a normal red color after remaining in the dark a few hours. This appears to demonstrate further that darkness causes dilation of the intraocular vessels resulting in increased vascularization of the inner eyeball.

According to Hecht (1919-25)[23] the visual purple is a photochemical substance split up under the influence of light into two components, and that when the light is removed, these two components combine again to form the original substance.

Since poor dark adaptation is found in eyes having either high or normal tension (such as in cases of the early stage of retinal pig-

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*Editor's Note: The main theme of the paper which stresses the anomalous behavior of the visual purple and its direct affect on primary glaucoma as influenced by light and dark is somewhat abstract and lacks widespread clinical and experimental support. It is suggested by Don R. Paine, member of the Editorial Council of the American Academy of Optometry, that the following footnote accompany this portion of the manuscript by Dr. Charles I. Saks, to the effect that neither confirmation nor denial is accorded the validity of the claims made in this thesis.

mentary degeneration), it seems that these two components forming the visual purple do not combine completely in darkness, with the result that some of each component is free to act individually, one affecting dark adaptation and the other causing dilation of the intraocular vessels, both substances being effective only in the absence of light, since we know that the intraocular vessels dilate only in darkness. This fact was demonstrated in Oguchi's disease. When the eye is exposed to light, one of these two components probably acts as the interposing medium in bringing about constriction of the intraocular vessels. An attempt will be made therefore to show that the chemical behavior of the visual purple appears to be the interposing medium between the dark-light stimulus and the response of the intraocular vessel musculature.

The further possibility of an interposing mechanism as a controlling factor in the action of the intraocular vessels is the *opposite* effect of light on the surface vessels of the skin. According to Laurens,[24] light, within physiological limits, may cause the cutaneous vessels to *dilate* and thereby allow more blood to go to the skin. During long continued exclusion of light, the skin vessels become constricted and the skin thus assumes a bloodless appearance. Furthermore, Balderry and Barkus (1924) demonstrated that the primary effect of irradiation is vasodilation.[25] It is interesting to note further that in long continued exclusion of light during polar expeditions the skin becomes quite pale, assuming a yellow-green color.[24] According to Laurens[24] the pallor of persons working and living in poorly lighted rooms does not necessarily mean they are anemic, but that the volume of blood going to the skin and underlying muscles is diminished. This has been demonstrated in an exhaustive study.[24]

The point to be emphasized here is the contrasting effect the light-dark stimulus has on the intraocular and cutaneous vessels. To recapitulate, light causes constriction of the intraocular vessels, and *dilation* of the cutaneous vessels; whereas darkness causes *dilation* of the intraocular vessels and *constriction* of the cutaneous vessels.

Now then, the fact that in cases of detached retina the diurnal pressure changes may be *absent*[12] or *opposite* to those cases where no retinal detachment exists, seems to show that an interposing mechanism exists in the eye, and that this interposing mechanism appears to be the visual purple, because it is not formed when there is a detachment of the retina, that is, if there is no contact with the retinal epithelium. (It is advisable at this time to point out that what appears clinically to be a retinal detachment is, in the large majority of cases, not a true

detachment, but a separation of the nervous portion from the pigmentary layer. According to Wolff, the only true detachment is in cases of sarcoma of the choroid.[26]) Therefore, in some cases of detached retina, the effect of the light-dark stimulus on the intraocular and cutaneous vessels is EXACTLY THE SAME.

From this it appears, therefore, that the cases presented by Hagen, Raeder, and Dominguez were those of detached retinas.[11]

It seems likely that the *total* effect of light and dark on the intraocular pressure in cases of detached retina may depend on the area and location of detachment, for light will cause *dilation* of those vessels in the region of detachment, and *constriction* in the region where no detachment exists. However, from the physiological standpoint, we cannot consider sharp lines of demarcation because it is possible that the area of detachment may vary because of movements of the eyeball. Even if the area of detachment should be constant, the physiological and physical areas of constriction or dilation would not necessarily coincide because nervous reflexes are well apt to extend beyond the border of detachment.

It is interesting to note that Hagen (1925), Raeder (1925), Feigenbaum (1928), and Magitot (1933) found that in secondary glaucoma, exposure to darkness may cause no variation in pressure, or the pressure may fall.[14] In those cases where darkness causes no variation in pressure, it may be possible that a destructive lesion has taken its toll, that is, disrupted the visual purple forming mechanism, or the tone of the choroidal vessels is non-existent due ot arteriosclerotic or other pathological changes. In those cases where darkness causes a *fall* in pressure, the result may be due to retinal detachment or disruption of the visual purple forming mechanism *without involvement of the choroidal vessel walls*. In the latter case, darkness would *not* cause a fall in pressure if the tone of the choroidal vessels for any reason was non-existent. It may be added that should light and dark cause pressure changes in secondary glaucoma similar to those found in primary glaucoma, then there may be a strong possibility that a *combined* glaucoma exists, that is, the possibility of a combined primary and secondary glaucoma. It may be added that the mechanism of secondary glaucoma is entirely different from that of primary glaucoma. While darkness causes no pressure variation in the cases of secondary glaucoma reported by Hagen, Raeder, Feigenbaum, and Magitot, it may also be added that light and dark will cause almost no pressure variation in normal eyes.[42] In cases of purely secondary glaucoma, it doesn't seem at all likely that light and

dark will cause any pressure variation.

If it is true that constriction and dilation of the choroidal vessels are controlled by the photochemical changes of the visual purple, then it appears that the physiology (or pathology) of the liver may have some relationship with the intraocular pressure. In the frog, pigment migration is stopped by the subcutaneous injection of bile salts (Yamada, 1919), or the isolation of the liver from the general circulation (Kumagai, 1915).[27]

Pathological changes in the liver have been associated with the etiology of night blindness. Injections of bile and its derivatives have a similar result in experimental animals.[28] In diseases of the liver, according to Percy W. Cobb, night blindness is closely associated with jaundice.[29] According to Adler, there is clinical evidence that some substance present in the liver is concerned with rod visual purple function.[30]

Because of the above facts, there may be some possibility that some excretory substance of the liver liberated into the blood stream may exert some influence on the behavior of the visual purple.

The writer makes no attempt to show that night blindness bears any relationship whatever to intraocular pressure or increased vascularization of the inner eyeball. Night blindness, or involvement of the dark adaptation mechanism, so far as the writer can see, appears to be merely a consequence in the anomalous chemical behavior of the visual purple.

It seems reasonable to believe that the aberrant behavior of the visual purple or its substance forming mechanism (the rods) may be regarded as an etiological factor of ocular hypertension in darkness.

The visual purple appears to be the interposing substance because of the following facts:

1. In retinal detachment, according to Duke-Elder,[13] the light-dark stimulus affects the intraocular vessels opposite to those cases where there is no retinal detachment, and the diurnal pressure changes have been found to be the reverse of those found where no known retinal detachment exists. According to Magitot and Hullard (1931),[12] in cases of retinal detachment, there is a loss of diurnal pressure variation. This would appear to mean that neither light nor dark have any effect on the intraocular pressure in some cases of retinal detachment.

2. In retinal detachment, we know there is no formation of visual purple in darkness.

3. In the normal young eye, the walls of the blood vessels are much more yielding than in older eyes. (Kerschbaumer[34] has shown that

there is clouding and thickening of the vessel walls of the choroid in the fortieth year and beyond.) Yet exposure to darkness causes a negligible increase in intraocular pressure in young eyes, being apparently absent, or varying between two or three mm. Hg.[35] This negligible increase may be due to reflex constriction of the circular muscle fibres of the vessel walls. In other words, the excess dilation of the intraocular vessels in darkness may be kept in check by the antagonistic action of the circular muscle fibres of the vessel walls. However, it seems more likely that hypertension in young eyes is not caused by darkness because there is probably a normal physiological functioning of the visual purple and the mechanism forming it, that is, when light causes the visual purple to split up into two substances, as brought out by Hecht,[23] these two substances probably combine *completely* to form the original substance when exposed to darkness. This reason seems to be borne out in cases of buphthalmos (infantile glaucoma).[31 33] In this condition, the marked yielding of the intraocular vessels brought about by the powerful dilatory action of their musculature, which in turn may be brought about by the anomalous behavior of the visual purple in darkness, may account for the extreme increase of intraocular pressure, 40 to 90 mm. Hg.

The "visual purple theory" may be questioned because the intraocular tension in the majority of cases of detached retina, while remaining normal at first or occasionally being raised, tends to fall to a subnormal level as the age of detachment increases (Nordensen, 1887; Leber, 1916; Kleiner, 1933).[19] The increased tension that may occur shortly after detachment may be due to a reflex active hyperemia because of the trauma. The subnormal tension in detachment of the retina, according to the writer, may be explained by the fact that the choroidal vascularization is diminished because of the cessation of retinal activity in the area of detachment, that is, the retina cannot function as a sight perceiving layer when the nervous portion is separated from the pigmentary layer. This means there is well apt to be a diminished quantity of blood in the eyeball. Apart from this, it is important to bear in mind that diurnal pressure changes, according to Duke-Elder,[13] in cases of detached retina, are opposite to those cases where no retinal detachment exists; and according to Magitot and Hullard (1931)[12] there is a *loss* of diurnal pressure variation.

The hypotension that follows contusions which do not rupture the external coats,[36] is brought on, I believe, by a chemical, physical or electrical disturbance of the retinal elements. This is shown in those cases where we see stars when receiving a sufficiently jarring blow to the

jaw or head, or when poked in the eye with a blunt object. Such mechanical disturbances may give rise to a chemical, physical, or electrical upset in so delicate a mechanism as the rod-cone system, probably affecting the chemical character, quantity of formation, or both, of the visual purple, resulting in extreme or abnormal constriction of the choroidal capillaries. This appears to be evident because retinal detachment sometimes follows. The extreme constriction of the choroidal capillaries, exclusive of a subretinal hemorrhage or edema is an important contributing cause, it appears, of detachment of an unruptured retina in contusions of the eyeball where the external coats have not been ruptured. It seems, therefore, that hypotension precedes the retinal detachment.

Since there is no structural connection between the pigmentary and neural layers of the retina, their separation almost seems to be an expected fact under suitable conditions.

One possible explanation of the immediate cause of detachment that follows contusions may be opposing electrical currents set up by concussion, due to the contusion, of the pigmentary and neural layers. (It is not impossible to set up a severe molecular disturbance in a delicately functioning organ like the retina.) If the opposing currents be positive, there is a possibility of the formation of hydrogen bubbles. It will take time, probably a few weeks before detachment takes place, since these currents, if they occur, may only be about .0004 to .0005 of a volt. Duke-Elder mentions the fact that there may be a considerable interval elapsing between the time of injury and the recognition of symptoms.[38] A slow formation of a gas could account for this phenomenon. In cases where no fluid causes the detachment, some substance, such as a gas, is necessary to maintain the separation and prevent re-attachment from the mere weight of the vitreous. If a fluid caused the separation, gravitation probably would cause a sacciform appearance in the detached area. The wavy appearance of a detachment could be produced by the variable pressure points of the constantly shifting jelly-like mass of the vitreous brought on by movements of the eyes. It appears that a flat detachment can be better explained by a gas separating the layers. If no substance separated the detached layers, then it would seem likely that post-polar detachments would disappear when remaining in the supine position. It is a well established fact that lying on the back for any length of time does not, by any means, cause a re-attachment. This point seems to establish the fact that there must be some substance, gaseous or otherwise, separating the retinal layers, especially in cases of glaucoma.

It is interesting to note that detachment may occur without holes in the retina, and holes may occur without detachment. In the case of macular holes, detachment is relatively rare.[48] (Sachs, 1930; Trantas, 1930-34; Gonin, 1930; Jeandelize and Baudot, 1932; Anderson, 1932; Pavia and Dusseldorf, 1933; Arruga, 1934; Vogt, 1934.) Evidence seems to show that a hole itself is not sufficient to cause detachment.[48]

In those cases where a hole without detachment exists, it may be possible that a gas or fluid formation, if any, could be forced through the hole into the potential space between the retina and vitreous. If such is the case, however, it does not seem possible that such a separation of the vitreous and retina could be observed with the ophthalmoscope.

According to Magitot and Hullard (1931),[12] in cases of detachment, there is a loss of diurnal pressure variation. This would appear to mean that neither light nor dark has any effect on the intraocular pressure. As was brought out previously, this may be due to a loss of tone of the choroidal capillaries. It was also mentioned previously that according to Duke-Elder,[13] in cases of retinal detachment, the diurnal pressure variations may be the reverse of those found in glaucomatous eyes without retinal detachment. It may be possible that the age of detachment is the deciding factor in this difference, that is, it may be possible that in cases of detachment of short standing, the diurnal pressure changes are the reverse of those found in primary glaucoma where no detachment exists; whereas in cases of detachment of long standing, it may be possible that diurnal pressure changes are non-existent.

Hypotension may also follow an *indirect* contusion which has primarily affected the facial bones.[12] Eyes having hypotension frequently behave irregularly, the pressure rising one day, and falling the next, the pressure remaining subnormal for a considerable time. These facts seem to emphasize a disturbance of a nervous mechanism, and suspicion seems to point to the rod and cone system. Magitot (1933) has found that the fellow eye, although apparently unaffected by the contusion, may share the hypotony reflexly.[37] This would seem to show that the vasomotor mechanism of the choroidal capillaries is directly affected.

The reversed or lost pressure variation in detachment of the retina seems to lend support to the fact that an interposing substance such as the visual purple, is essential for the *normal* respective constriction and dilation of the choroidal capillaries when exposed to light and darkness. This appears to be so because the respective bleaching and regeneration of the visual purple is dependent on exposure to light and dark.

Seidel (1920)[14] observed a rise of from 20 to 80 mm. Hg. after a half hour exposure in the dark, and a return to normal within a half hour in the light, and Poos (1934) found a rise of over 15 mm. in 70% of his cases of primary glaucoma, which was usually lowered by the previous instillation of eserine. However, Poos does not state the percentage or the amount of drop in tension caused by the previous instillation of eserine. It was brought out in previous papers[1,2] that cases have been recorded where an acute rise of tension followed the instillation of pilocarpine. It was also brought out in a previous paper[1] that dark adaptation causes dilation of the intraocular vessels resulting in increased tension in blind and seeing eyes, occurring indifferently in aniridia, after an iridectomy and with pilocarpine or atropine. (Feigenbaum, 1928-29.[32])

Exposure to darkness for only one hour of patients suspected of having the very early stages of primary glaucoma may not be enough to cause a sufficient rise, if any, in tension. The history of symptoms will speak for itself, such as nocturnal and early morning ocular, frontal and temporal pains, nausea, vomiting or a choking feeling that may awaken the patient from sleep. As the condition progresses, the eyelids may be puffy upon arising in the morning, and the room will seem to be full of smoke or fog. In the early stages, it may require exposure to darkness of at least four to six hours to give rise to some of the above symptoms.

If the room seems to be full of smoke or fog when arising in the morning, there will be a halo around lights. The foggy vision which may be due to edema of the cornea, upon rising in the morning, will be much more noticeable on sunny than on cloudy mornings because there will be more scattering of light within the eye. The scattering of light may be due to the minute droplets of fluid in the cornea. The hazy vision will disappear gradually about three hours after arising. *It is interesting to note that the acuity may be better than expected, even though the surrounding atmosphere seems quite hazy.*

There are cases where patients, *not* having glaucoma, arise in morning with clear vision which becomes misty or foggy about two hours *after* arising in the morning, see haloes around lights, becoming *increasingly noticeable* for the next two or three hours, and then gradually disappearing. They may *not* complain of morning headaches or other discomfort. This condition appears to be due to nasal catarrh because in the few cases observed, the patients complained of a stuffy nose upon arising in the morning. While these patients were referred to a rhinologist, no report so far has been received because a rhinologist was not consulted as advised.

There seems to be anatomical evidence to support the supposition that nasal catarrh may be the cause. According to Whitnal,[49] all the accessory nasal sinuses have in the venous system branches which pass into the orbit, then through the ophthalmic veins into the cavernous sinus. It is also thought that some of the lymph channels of the accessory nasal sinuses may possibly take the same course.

The mechanism causing the halo in both conditions, apparently, is not the same. In cases of primary glaucoma, there is abnormal dilation of the choroidal capillaries, causing a state of increased pressure within the eyeball. In this case, pressure is brought to bear on the veins of the eyeball, thereby causing blockage of the venous blood and lymph, as well as impairment of the blood supply to the eyeball. Exposure to light causes constriction of the choroidal capillaries, resulting in an almost immediate relief of intraocular pressure.

In the non-glaucomatous halo, the congestion, apparently due to nasal and accessory sinus catarrh, is probably due to increased body activity. After two or three hours, the congestion is gradually relieved allowing a more normal lymphatic and blood circulation.

It is of interest to note that the size of the halo is independent of the pupillary diameter. By placing a pinhole disc before the eye seeing the halo, the diameter remained unchanged. The pinhole merely caused a diminution of intensity of the halo. The larger the pupil, the greater the intensity.

The diameter of the halo is directly proportional to the distance from the light source, that is, the greater the distance the greater the diameter but the less the intensity. The intensity, of course, obeys the law of the inverse square ratio.

The depth of the anterior chamber does not appear to exert any predisposing influence in the occurrence of glaucoma. In the young, the anterior chamber is deep, and in the old shallow.[15] This may be due to growth of the lens which is ⅓ larger at the age of 65 according to Priestly Smith. In emmetropes the chamber is deeper than in hyperopes, and shallower than in myopia. If a shallow chamber alone, as is found in hyperopes, is responsible for the occurrence of glaucoma, why have not all hyperopes glaucoma?

According to Raeder (1923),[15] the depth of the anterior chamber does not vary closely with the tension. In a previous paper[1] it was mentioned that the reason primary glaucoma is found mostly in hyperopes is probably because our population is made up mostly of hyperopes. According to Magitot and d'Antrevaux (1925),[15] the quantity of

aqueous which can be abstracted from an eye with a shallow chamber is less, and Magitot (1931) and Hodgson (1938) have shown that its composition is normal. On the other hand, in acute congestive cases, the chamber is always shallow and the slit lamp reveals that the aqueous is usually cloudy due to excess protein. It is interesting to note that Collins has shown that in cases of ophthalmomalacia there is an edema of the iris and a coagulum in the anterior chamber.[17] This case appears to further weaken the theory of drainage interference as a cause of primary glaucoma. It appears that a cloudy aqueous is a result rather than a cause.

The depth of the anterior chamber appears to be the result rather than a contributory factor of ocular tension. According to Salzmann,[41] enlargement of the lens in old age is compensated by defective secretion of aqueous. He has also shown that the free space of the posterior chamber is narrowed because of enlargement and thickening of the ciliary processes, the lens and zonular fibres. Furthermore, statistics show that the average intraocular pressure is the same in both youth and old age.[42]

There is further evidence that the aqueous secretion appears to be controlled to some extent by increased tissue content of the eyeball. According to Gradle,[43] if a tumor is located in the posterior half of the eyeball, secondary glaucoma is a late manifestation or may be entirely absent. However, he points out that anterior segment tumors are most likely to cause incompensated attacks of hypertension. This may be due to mechanical obstruction of aqueous drainage. Wilmer[44] reports three cases with malignant growths of the posterior segment of the eyeball having normal tension. However, it may be that a sufficiently abnormal increase of tissue formation in the posterior segment may give rise to hypertension as in cases of the late stage of pigmentary degeneration of the retina, where the rise in tension may be due to a proliferation of glial tissue within the eyeball. Evans mentions the surprising frequency of increased intraocular pressure in cases of retinitis pigmentosa. He also cites the investigations of Shoemaker who emphasized this point.[47] (For a more complete discussion of this phenomenon, the reader is referred to reference No. 2 in the bibliography.)

Reasoning from the above facts, the reader may ask why there is not sufficient aqueous secretion to overcome hypotension.

The deepening of the anterior chamber in myopia and hypotension is apparently due to an increased volume of *space* of the vitreous chamber. In cases of increasing myopia, growth (*not stretching*) of the sclera without a corresponding volume increase of vitreous probably accounts for the deepened anterior chamber.[45] In cases of hypotension with or

without retinal detachment, the marked constriction of the choroidal capillaries, along with an added probable decrease of choroidal vascularization in cases of retinal detachment, will cause an increased *space* volume of the vitreous chamber.

In hypertension, the aqueous cannot drain fast enough to conpensate for the increased tension, whereas in hypotension, the aqueous probably cannot be secreted fast enough to overcome both the fluid drainage and decreased tension.

It is interesting and important to note that the pressure in the aqueous chambers and vitreous chamber is the same. Experimenters have not found any measurable difference. (Adamük, 1867; v. Schulten, 1884; Hamburger, 1914; and others.) Priestly Smith (1888) found that an increased pressure of 1 mm. Hg. artificially generated in the vitreous chamber led to an almost complete obliteration of the anterior chamber.[13]

In a previous paper it was shown that myopia does not appear to have any relationship whatever to ocular hypertension.[31] It is interesting to note further that Collins (1917)[18] reveals that loss of tension in the coats of the eye leads to relaxation of the zonule and a forward displacement of the lens with resulting myopia.

Duke-Elder[19] states that the connection between hypotony and axial myopia is well known, but that the association is not invariable. According to Lagrange (1922), about one-third of myopic eyes over —8.00 or —10.00 have a hypotension. This has been substantiated by Urio (1933) who found over a series of thirty-five markedly anisometropic cases with unilateral myopia, in 80% the eye with the high myopia had a tension lower than the fellow eye.

While refractive changes in simple glaucoma may occur in the direction of myopia due probably to advancement of the lens,[20] more commonly the change is toward an *increase in hyperopia.* According to Duke-Elder, *an early and rapidly increasing presbyopia is a common and significant sign of early glaucoma.*[20]

CONCLUSION

1. It appears quite definite that primary glaucoma is not due to drainage interference.

2. Primary glaucoma does not appear to be related to blood pressure changes.

3. Hypertension and myopia appear to have no relationship whatever.

4. The etiology of primary glaucoma appears to originate in the

aberrant behavior of the visual purple or the mechanism forming it when exposed to darkness. Since light and dark are definitely known to affect pressure changes, especially in primary glaucoma, it seems likely that the anomalous behavior of the visual purple or the mechanism forming it may be the seat of the trouble because their behavior is *dependent upon light and dark.*

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ULTRA-VIOLET—A NEW HEALTH GUARD FOR THE REFRACTING ROOM*

H. W. Alexander†
Erie, Pennsylvania

A new science is engaging the interest of people everywhere—the science of disinfecting with ultra-violet. So important has it become that leading publications are discussing it widely. The SATURDAY EVENING POST, NEW YORK HERALD TRIBUNE and AMERICAN WEEKLY are among the many that have devoted feature space to the subject in recent weeks.

Of more immediate interest in optical circles is the attention being directed to this subject by professional men. The eminent New York Optometrists, Drs. Ryer and Hotaling, recently wrote a comprehensive paper[1] in which they pointed out the efficacy of germ-killing ultra-violet.

Eminent scientific authorities and public health workers have demonstrated that bacteria-laden air arising from common occupancy of enclosed spaces constitutes a universal hygienic hazard. Wherever people congregate, infection may be transmitted by air-borne communicable disease germs. To combat resultant cross-infection and epidemic spread, investigators have determined by controlled studies, that sanitary ventilation equivalent to 100 air changes per hour is necessary to secure any marked reduction in the transmission of air-borne contagion.

Effective stationary ultra-violet lamps, to be affixed to walls, have been developed which provide a germ-killing capacity of from 100 to 500 air changes per hour—an efficiency far in excess of established requirements. Air-suspended micro-organisms are destroyed by this means at a rate far greater than can be accomplished by any other method of mechanical ventilation.

Evidence of success in combating air-borne infection can be found everywhere. Schools, hospitals and business offices where units have been installed have factual proof of the efficiency of ultra-violet's war on microbes.

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[1]E. LeRoy Ryer and Elmer E. Hotaling. Notes on the Hygiene of the Refracting Room. Amer. Jour. Optom. and Arch. Amer. Acad. Optom. 23. 2. 76-79. 1946.

The optometric profession may well enjoy the benefits of this new health-guard, for a steady stream of patients in a refracting room or a dispenser's office will generate as high a germ count as in any other enclosed area.

Indeed the refracting room may harbor the germs of communicable infections not only in the air but also on the surfaces of refracting and orthoptic instruments which come in actual contact with the patient's skin, or which may be in close proximity to the patient's nose and throat. For many germs come to rest on these surfaces and are not circulated by normal thermal currents, consequently they may not be destroyed by floating into the direct beam of the ultra-violet wall fixture.

To provide ultra-violet disinfection for these surfaces, a new optical unit has been designed which provides the killing effects by bringing the lethal rays to the exposed surfaces. This is a completely portable device which hangs on the wall when not in use but either just before a patient's appointment, or even in the presence of the patient, is carried directly to the instruments to be used where it is turned on and the rays beamed directly on the contact surfaces at very close range.

Bacteriological tests have demonstrated effective killing power in the zone of irradiation at distances as great as 35 feet from an ultra-

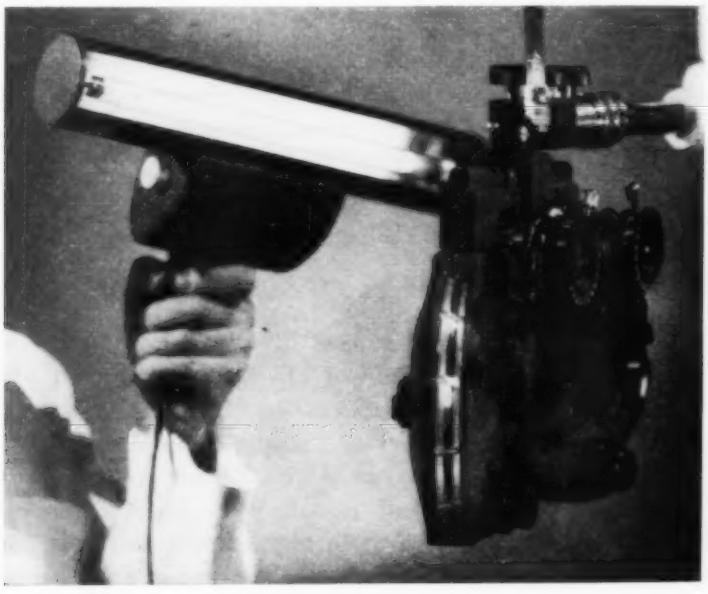

Figure 1. Portable unit brings ultra-violet to surface-bound bacteria.

violet unit. The portable unit is designed for very close application, thus greatly increasing its disinfecting powers.

Through these new units it would appear that optometrists and opticians have an opportunity to provide another added assurance to patients that every means is being taken to safeguard their health. As such, these instruments probably will contribute appreciably to building practice, at the same time providing a definite measure of protection for the optometrist or optician himself. Such evidence of willingness to accept and use new and proved methods and devices of all types cannot help but build a greater public confidence in the ophthalmic profession.

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THE SHEARD FOUNDATION

Some time prior to World War II the creation of the Sheard Foundation at Ohio State University was announced. Under the able leadership of a group of Ohio optometrists a substantial fund-raising campaign was inaugurated to support this worthwhile movement. Optometrists in all parts of the country made contributions and a considerable sum of money was not only pledged but paid in by these donors. As a result of these prior efforts, optometry is now in a position to conclude its portion of this worthwhile endeavor which pays tribute to one of the great founders of professional optometry, Dr. Charles Sheard, who

was instrumental in founding the School of Optometry at Ohio State University and who did so much to place ocular refraction on the high scientific plane we find it today.

During the war the campaign for funds for this worthwhile project was of necessity held in abeyance, but (with the ending of the war) the time is now ripe to go forward and finish this job in the-only proper manner and that is, with complete success in the raising of the necessary monies to fulfill all the needs at this center of optometric learning.

The project as it stands today consists of two parts, each bearing fine tribute to Dr. Charles Sheard. The first is the erection of a building at Ohio State University to house that School of Optometry. The second is the creation of a visual research department under the graduate school to carry forward the work of this outstanding leader and to develop research specialists and teachers who will be able to maintain the high levels of optometric education commensurate with teaching standards of the future.

It is proper and fitting that optometry conclude this great work conceived to honor a great scientist and a man who has placed so outstanding a mark upon optometry. It is now just thirty years since Dr. Sheard first became identified with work in our profession. During this entire period, whether in optometry or in other fields of research, he has never lagged in his desires to uphold the good inherent in this profession and to champion the rights and sound techniques used by optometrists. During this thirty-year period he has contributed much to the development of optometry, and has served as an inspiration to many of its present day leaders. His counsel has proved wise and just on innumerable occasions when such counsel was of invaluable benefit to all optometrists.

It is a fine thing, therefore, that the profession move forward with this tribute to this great man of vision, and it is very fitting that this contribution to visual science be given in his name at the seat of learning which he founded several decades ago. It is a fine thing, too, that he lives with us today to witness this tribute to his unselfish devotion to the better things in visual care, and the writer joins the great group of optometrists who look forward to the early consummation of this permanent memorial to optometry's love and admiration of their great friend, fine counsel, and able scientist, Dr. Charles Sheard.

CAREL C. KOCH.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

PROGRAM COMMITTEE ANNOUNCEMENT TO SPEAKERS AT ANNUAL MEETING

The Program Committee of the American Academy of Optometry announces the following rules for the presentation of papers at the Annual Meeting in December, 1946:

1. All requests for time on the program are to be made to the Program Director, Dr. D. G. Hummel, 419 Guardian Building, Cleveland 14, Ohio.
2. The title of the paper is to be received by the Program Director no later than August 15, 1946.
3. Papers are to be submitted for review to the Program Director not later than September 15, 1946.
4. State the time required to deliver the paper, when it is submitted for review. The time allotted for discussion is generally one-half the time of that allotted for delivery of the paper.
5. Indicate your choice and an alternate for a discussion leader. The Committee will assist and offer suggestions if you have no choice.
6. Instructions for preparation of final paper will be given when the review copy is returned.
7. Sections:

   The individual programs of the sections will be concerned with discussions and demonstrations of their particular field. Papers to be presented for publication must follow the foregoing six (6) rules as stated.

   Those not for publication are to be presented directly to the Chairman of Sections, Dr. W. Edward Dewey, 314 Hamilton Lane, Battle Creek, Mich., not later than October 15, 1946. Since it is desirable for the general membership to have an insight into the work of all sections, most of the papers for publication will be presented in the regular program.
8. All papers, unless prior requests or notifications to the contrary have been made, become the property of, and will be published by, The American Academy of Optometry.

SPECIAL REPORTS

THE CASE SYSTEM IN TERMINAL OPTOMETRY*

John A. Cronin†
Fitchburg, Massachusetts

When is optometry to have a record of leading cases? When may the solved problem case be available to all? When will optometry begin to preserve such valuable information in its progress to a higher level and wider field?

A profession is no more efficient than its skill and fund of knowledge. Even the benefits of civilization itself began only when man was able to preserve and communicate for posterity his ideas and achievements. The invention of printing from movable type was the quickening factor in this spread of how and why.

Professional optometry can advance to a higher and broader level only as fast as its knowledge and achievement is shared by the greatest number. If those great minds of yesterday, such as Donders, Helmholtz, Tscherning and others had not made the foundation of today's optometry by communicating their ideas, principles and findings, we would still be in the dark-age of refraction and orthoptics.

Optometry of today can contribute much to the optometry of tomorrow by adopting the case system idea similar to that used in medicine, business and law. Such system might be called by one of two titles —"The Leading Case System in Optometry" or "Problem Case Achievements in Modern Optometry."

An example of the wrong treatment of a problem case under such a proposed plan can be cited. During the spring of 1944 an optometrist of Washington, D. C., published an incomplete outline of a problem case of blurring lenses, of a year previous and with his report he appealed for suggestions.

The case was not too clearly stated. But the problem of a blur was assumed from remarks contained in several published letters written by the patient who was a scientist formerly with the Optical Division of the Bureau of Standards. The patient's unusual knowledge of optics made him curious as to why he could see distinctly through the testing lenses but could not obtain clear distance vision through his prescription

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†Optometrist.

lenses, which instead, produced a central blur for distance. His prescription of April 26, 1943, at the age of 53, was subjectively:

O.D. + 1.50 D. sph. ⌒ — 0.75 D. cyl. axis 177.

O.S. + 2.25 D. sph. ⌒ — 0.75 D. cyl. axis 180.

O.U. + 2.00 D. sph. addition. Full-View Bifocals. Two weeks later, May 10, 1943, the following quotation from the patient's letter seems to state the issue of his problem. "I can't understand why I appear to see distance images through the central portion of the test instruments, and a few days later put on a pair of lenses allegedly made according to the indicated combinations, and do not have clear vision at the center; but find it clears up when I turn and look through the margins."

This patient first came to the Washington optometrist in 1923, at the age of 33 years. His prescription was then O.U. + 1.50 D. cyl. axis 90. Subsequent visits were made in 1925, 1927, 1931 and 1941 but no findings were given. Between 1931 and 1941 the patient visited other optometrists and also an ophthalmologist who had taught for 15 years at George Washington University.

Whatever the prescription the patient was wearing from May, 1942, to February, 1943, he had the same type of blur for distance. He wrote during this period to the research departments of two large optical manufacturers to secure suggestions from them if possible. In his letters he is quoted as stating at that time, "the only difficulty is that I do not see distinctly through a certain portion of my lenses. From three feet to twenty or thirty feet I do not notice any indistinctness. Beyond this everything is blurred through the central portion of the lenses. If I cock or tilt my head so as to look through the edge portions of the lenses, the images clear up."

The research departments were unable to solve the problem. On April 15, 1944, the Washington optometrist made his appeal for help to the optometrists of the country. The writer sent in several suggestions. No acknowledgement came until after two months when I then received a mimeographed note stating that my reply was to be incorporated in an article to appear soon. The article appeared July 15, 1944. The author named 16 optometrists who had made suggestions and he reviewed these. At the same time the Washington optometrist stated that the patient no longer was living in Washington but that he does occasionally visit the city and at a later date a report will be presented to the profession relating to the suggestions received. No further report has been published during the last 16 months.

A similar example of a problem case in apparent accommodation spasm was given in an ophthalmological journal three years ago. In this case report a patient changed from one specialist to another because he did not have comfort with the glasses he was wearing. The second specialist treated the patient with a cycloplegic for three months, but then found that the subjective refraction was exactly the same as the patient had been wearing. The ophthalmologist appealed to the editor for suggestions. He listed ten retinoscopic findings of about +1.25 more than the subjective refraction. The answers to this appeal were not sent to the ophthalmologist but to the editor, who published the answers. The conclusions were to continue with the cycloplegic, even though the three-month period of treatment was already exceptionally long. There was no suggestion as to the probable cause of the spasm nor were orthoptics recommended.

Neither of the two preceding cases should have a place in a "Leading Case System" or "Problem Case Achievements." Both cases state a problem but do not give a solution. The place for the two cases is just where they appeared; they belong in current technical journals, for though incomplete, they stimulate and arouse interest.

Two recent views by editors themselves on the purpose of a journal of optometry and ophthalmology are available. The consulting editor of the AMERICAN JOURNAL OF OPHTHALMOLOGY, Dr. W. H. Crisp, in the August 1945 issue, evaluated the periodical literature of ophthalmology as containing a moderate amount of distinctive quality. But, he pointed out, the eye journals of the various countries do "constitute a great debating society, in which are expressed not merely original investigation into scientific matter, but widely varying experiences and conditions of treatment."

The editor of the OPTICAL JOURNAL AND REVIEW OF OPTOMETRY, Maurice E. Cox, in his September 15, 1945, issue, discussed the literature of optometry. He admitted that this literature constitutes "A rather scanty store. It would be almost negligble were it not for the material that has appeared in the journals. . . . There have been many teachers in optometry, good, bad and indifferent, but all too many of them confined their knowledge to the four walls of the class room. There were some who made their mark in private practice, but most of them were either too busy to write or felt no compunction to share their knowledge with their fellows."

Problem cases in optometry and their apparent solutions have for many years appeared in the Optometric Extension Program. But the

foundation of the O. E. P. is the table of expecteds. This table has never been proved to be true. It is probably not true. The table, I am told, represents the measurements of a hypothetical normal boy of 17 years. The measurements of all persons are compared with this table for either agreement or difference. Agreements with it are called normals. Disagreements are called abnormals.

The table was published in 1931 by Dr. A. M. Skeffington in his book "Differential Diagnosis in Ocular Examinations". Only one page was used to announce the origin of that table. The chances are that many men in 1931, who read Dr. Skeffington's book, were ready to yield a point by accepting his conditional table while he carried out his investigation of analytical optometry. The table of expecteds was soon memorized. Repetition made habit; and habit soon accepted as a fact what was only a hypothesis.

But the word hypothesis means conditional or suppositional. And in the case of the hypothetical normal boy it should mean that the table was assumed conditionally or tentatively as a basis for investigation. New facts may change any hypothesis. The first hypothesis about the world was that it was flat.

In an experiment one tries to collect the facts he needs to support a hypothesis. If the facts don't exist, he changes his hypothesis and starts anew to find supporting facts for a different hypothesis. The scientist also uses the words "average" and "normal" cautiously. They are part of the statistical method for reaching scientific conclusions. The word "normal" may be roughly defined as conforming with an accepted standard. The word "average" has five common meanings: the arithmetic, the geometric, and the harmonic mean, the median, and the mode. The popular meaning of "average" is the arithmetic mean or average. This average is obtained by adding the value of the cases and dividing the sum by the number of cases. This definition is probably the meaning intended by Skeffington in his use of the word "average".

In the year 1939, eight years after Skeffington published his table of expecteds, Dvorine published a book of 150 pages entitled, "Theory and Practice of Analytical Refraction and Orthoptics". But Dvorine offered no aid to the origin of the table of expecteds. He merely endorses Skeffington in the preface. Thus: "After ten years of the study of the theories and principles first advanced by Skeffington and having had the opportunity to apply these theories to the test of office practice, I am firmly convinced of their soundness."

In chapter I, Dvorine spent nine pages in an endeavor to define emmetropia. On page five he remarked, "If there is no emmetropia, there is no normal refractive status". (Not even for a boy of 17 years?)

In chapter IV Dvorine treated the subject of "Normal Expecteds" in 19 pages; but he did not touch on the origin of the O. E. P. table of expecteds. Nor did he attempt to prove its certainty. At the end of this chapter one can easily infer that the O. E. P. table of expecteds which started as a small hypothetical sprout has now grown to the size of a majestic oak and that its present size is proof of its accuracy.

An authority on ophthalmology, an unusually competent author, has within two years made a definite statement on the veracity of the O. E. P. table of expecteds. He has appraised the entire twenty-one points in a letter from which I quote.

"As nearly as I can make out you give the findings which one might obtain in examining a normal boy 17 years of age, but I am not clear as to what you plan to make of these figures. You cannot use them as a guide to whether the next boy is normal or not, because your ideal boy is only one sample and hundreds of differences from these figures will be found in examining a hundred other normal boys.

"In the same way variations in heterophoria are quite large and so are the amplitudes. His convergence for instance (what you call adduction) will vary with repeated tests as he learns each time to do it better so that whereas 20 (prism power) might cause diplopia at the beginning, after a little practice he could do 30."

The Skeffington hypothesis of the table of expecteds has been living dangerously. It should be verified with great care, with many facts, and with a variety of statistical reasoning. A lot of evidence is required to prove this theory or hypothesis. For today it is almost a maxim with the anthropologist, the biologist and the anatomist that you cannot use a boy of 17 years as a standard for measurement of the human race.

Daring generalizations have their place, but they must clash on the battlefield of scientific verification and progress. The burden of proof rests on Skeffington to establish his unusual generalization or remove it from the platform of approved knowledge.

The Medical and Other Case Systems

There are three kinds of established reports by the case system. These are the medical, the business and the legal reports. They are worthy of discussion here because they offer suggestions for optometry. Some of the inherent suggestions may be negative and others positive.

Optometry in establishing a system of ocular refracting has need for adequate case reporting and should naturally study similar attempts by other professions, in order to avoid mistakes and to adopt good points discovered by long practice and experience.

Medical Case System: Example I. "The medical case records of the Massachusetts General Hospital," Boston. Published weekly in the NEW ENGLAND MEDICAL JOURNAL. These are considered standard. The Sub-heading is "Weekly Clinopathologic Exercises." Cases, I understand, are taken from a paid clinic. The Clinic is often referred to as the Cabot Clinic because of its founder, Dr. Richard A. Cabot, who was a diagnostician and faculty member of Harvard Medical School.

The case reports occupy from two to seven pages in this journal; often these reports carry many illustrations. The heading of each case is the hospital number. Then follows the caption, "Presentation of the Case." The opening paragraph gives the nature of the case at the time of hospital entry. The X-Ray photographs often give at a glance the probable nature of the case. A sure way to identify the exact nature of the case is at the end of the report under the caption of "Diagnosis."

Each case report follows the same pattern. This pattern is divided into the following major divisions: "Clinical Diagnosis"; "Dr. ——— Diagnosis"; "Anatomical Diagnosis"; and "Pathological Discussion."

Each case report begins, under "Presentation of Case," with the age, sex and cause of complaint on entry to hospital. Then the preceding history in detail, including social and family conditions. The findings of numerous tests are given in detail.

Under the heading "Differential Diagnosis" are a number of paragraphs of observation by the different specialists. The form here might be called a dialogue or narative method. In one case a specialist begins with the statement: "As usual I have two possibilities in mind." And further on, this same specialist begins with the admission: "I am still in a quandary." And still further on, this author says: "I am still trying to decide whether he had, etc."

In another case, the opening remark begins: "This is a long case and I do not believe there should be much discussion about the diagnosis." Then the diagnosis proceeds with scientific reasoning, with cause and effect, and facts and observations arranged to produce a logical conclusion.

Under "Anatomical Diagnosis" the comments are very brief, and are often like sub-headings, some with heavier faced type than other lines.

The "Pathological Discussion" naturally varies in length. This discussion is participated in by several experts, with statements, questions and answers.

These reports could be improved in setup for educational and reference purposes. The reports also use a certain informality which would be eliminated in a text book. But one feature these reports bring out better than any text book is the variety of opinion with reasons for disagreement. The obvious frankness of the specialists is quite refreshing. They show a total lack of superiority complex. They emphasize the scientific objective method for aid in securing results.

Business Case System: Example II. The second example of the case system is the Harvard Business Case reports of the Graduate School of Business of Harvard University. This school was founded in 1908. I now quote from the schools catalogue No. 18 of July 15, 1945.

"The University Authorities believe that the elements of business administration could be defined and taught better, more quickly; and to higher social purpose by such a school than by the traditional apprentice shop, in business or the dogmatic courses in business routine then offered by a variety of institutions. The growing complexity of business and the trend towards larger business units had made it difficult for an apprentice to learn the whole of any process or to see clearly the relationship of his work to the other functions of an enterprise. The School undertook to give college graduates an opportunity to study business problems and principles under adequate guidance and with minimum emphasis upon routine."

During the two and one-half years prior to July 15, 1945, there were over 13,000 Army, Navy and Marine Corps officers studying at the Business School. Over 4,900 of these officers graduated from military training programs developed and taught by the Faculty. These courses were originated on the belief that the administration of military supply problems involved inherently the same abilities that are required in the administration of business. These courses were in production, distributation, use and control of supplies. In May 1943 the last civilian candidates for degrees left the school. The total resources of the school were then devoted entirely to the war effort. During the same period more than 400 businessmen completed the War Industry Training program and from 1908 to May 1943, the school had awarded 7,757 degrees to its civilian graduates.

The business case method covers actual business situations and problems, which the graduate student must analyze in order to develop

the capacity to act by doing. The material in the cases is a transcript of real business life; and the material has been gathered by the Faculty and research assistants since 1920, when organized case preparation began.

"The Graduate Student who studies under the case method is repeatedly placed in situations where as an administrator he must not only evaluate evidence but also act with responsibility. No equally effective method has revealed itself for compelling a man to meet successfully new situations in which he must grapple intellectually with fresh combinations of facts, half-facts and opinions. There are no answers for him in any book.

"Through the study of a large number of specific cases involving the experience of many companies, the student acquires a background of facts and current useful generalizations, however, these do not automatically afford answers to new problems, which have a way of not being typical. Learning how to differentiate one situation from another and how to recognize the more important issues in cases contributes to the development of administrative capacity."

Students are also obliged to submit their own written comments on certain case problems. For in actual life there is often more than one way to solve a problem; and the least expensive way may not be the most practical.

There is a total of about 18,000 cases gathered since 1920. This reservoir of case situations makes possible a collection of probably from 200 to 600 cases for the principal kinds of industry and commercial business. Many of these cases have been published in bound volumes by a New York publisher, and should be available in the public libraries of the larger cities which maintain a business library department.

Legal Case System: Example III. The third example of the case system is the way the legal profession records and preserves its solved problems for further reference. These records are called reports; these reports consist of the opinions or decisions of judges of cases heard by them.

A civil case is really a dispute between two parties who cannot agree, and so go to court about the dispute. The case thus becomes a legal contest between two sides. Arguments and proofs are presented by each side and the court then gives a decision. The decision is based on the law, and the judges give reasons for their opinion or decision. The judges' decision of a case may also establish a precedent for settling future disputes. Once a legal principle is established in one case, it is the practice of our highest courts to generally accept this legal principle as precedent in later cases.

The system does not necessarily "freeze" the adaptability of the court to changing conditions. Even after a principle has been established in the higher court, it is at times interpreted to the vanishing point in later cases that may appear quite similar. Also a court has frankly reversed itself by taking an opposite position in a later case, thus rejecting or nullifying the precedent of an earlier case that was expected to hold. Nevertheless the study of precedent in earlier decisions is an essential part of a lawyer's work in giving advice to a client.

Thus the lawyer is constantly using the legal case system to simplify his problems and to reduce his time in reaching solutions of similar difficulties. Certain principles are used again and again as the bases of deciding cases. These principles represent reliable authority.

More than 15,000 cases with opinions rendered in the United States in 1934 have been counted. These cases had a variety of fact. The judges who rendered these decisions were mindful that the facts were particulars to which the general law had to be applied.

The law schools teach facts about the law, and emphasizes these facts by requiring the reading of reports, by the hundred, of decided cases. These cases are then gone over in class under the questioning and lecturing of teachers in order to develop in the student a true sense of the law as to principles amid a variety of details called facts. For difference in details is very important in law.

The law itself has been criticised for being out of tune with scientific thought. The law has been called static, while the sciences have been marching forward. One prominent writer, Percival E. Jackson, in "Look at the Law," 1940, has the following comment: "Today judges need, even more than the lawyer, a broader knowledge than mere acquaintance with legal precedents and statutes brings. They must test their judicial reactions, they must view the subjects of their judicial surveys by recourse to economics, social and other scientific fields. They must know something of the natural and physical sciences, the whys and wherefores of the concepts they enumerate, and the rules by which they enforce them."

The United States Supreme Court gets around the need of sticking to a certain precedent by distinguishing the essence of a new case. Decisions opposite to what one would expect from earlier established precedents are based on changing needs and attitudes. The court uses factual differences, and it explains or ignores similarities and statements of general rule.

The reports or decisions of the highest courts follow a distinct

pattern. This pattern is similar in all decisions in order to simplify research and comparison. An outline of such a pattern as used in the New York Court of Appeals will serve as a general illustration of a typical pattern. The New York Court of Appeals is the highest court in New York. It is on a par with the Supreme Court of Massachusetts. The illustrative case which follows is taken from "Law Books and Their Use," second edition (1924).

The divisions of this pattern are I. The Title, such as Jones vs. Brown. II. The Catchwords. III. Headnotes or Syllabi. IV. Prefatory Statement of Facts. V. Summary of Appellant's Brief. VI. Summary of the Respondent's Brief. VII. Opinion Begins. VIII. Dictum. IX. Disposition of the Case. X. Concurring Judges. In some states a more simplified pattern is used.

Judicial Reports are more important than the layman realizes, for "the Fountain head of the law is the decisions of the Courts." These decisions do two things: they declare the law on points not covered by legislation, and determine by judicial construction of constitution and statute their ultimate effect. Even the effect of Statutory rules of law is dependent upon judicial interpretation. Hence, lawyers must go to the decisions for authoritative information as to what the law is. He also must go to them to ascertain whether the weight of authority is in his favor. If it is apparently against him, he must study them to find the proper solution for his client. His success in his profession is largely dependent upon his knowledge of the decisions of the courts, and his ability to analyze case reports and understand them.

This situation of the law has brought out the criticism that the law is too static. The most outstanding criticism of this situation was when President Roosevelt charged that the United States Supreme Court was adhering too much to the past conditions and was not adjusting its view to the changing conditions of the country.

A more recent view of the need of change in law is expressed by Everet Fraser, Dean of Law School, University of Minnesota. His views, part of which are quoted, were published January 1944 in the Annals of the American Academy of Political and Social Science. Said Mr. Fraser: "If this summary of the law and the lawyer's function is correct, it connotes changes in the training of lawyers. Law students have been taught the existing legal rules and how to administer them. They have not been taught to formulate new rules and standards essential to keep abreast of the changing conditions and problems of the times. Knowledge of the existing rules is important, since they are the

products of past ideas and experience. Legal education should begin with them, but it should train students to be always alert to the necessity of change.

"Law is not preordained. It is not a set of unchanging institutions and rules. Law and legal institutions are the product of a progress which never ceases. The institutions and laws of the past were the products of social, economic and political ideas. The law must change with the ideas which produce it. There has never been a set of rules that will satisfy all peoples at all times and will satisfy their sense of justice under all conditions. The law as we conceive it is the expression of the life of a people. They do not mold that life. History teaches that there is one and only one law of human relations that is constant. That is the law of change. The law that will suit a given people at a given time is determined by the ideas, temperament, habits, and conditions of that people at that time. Thus the law must vary with the people concerned, and for a given people from time to time."

CONCLUSION

Optometry can take a good suggestion from the words of the Dean of Law, Everett Fraser. Thus, "there is only one constant law of human relations and that is the law of change." If optometry is too static in its way of progress, now is the time for change for the public good. A changed world is before us. The postwar era of change and progress is already under way.

If a record of the case system of problem achievements will enrich the literature and advance optometry, there is much that optometry can adopt from the case systems of medicine, business and law.

Why not become dynamic and create such an optometric system? Make the system looseleaf. Make the system a quality goal, too. A few well written cases a year, to begin, would be a decided achievement.

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ANNOUNCEMENTS

FEINBERG AT PURDUE UNIVERSITY

Dr. Richard Feinberg, B.S., D.O.S., formerly Supervisor, Eye Service, Sperry Gyroscope Company, Inc., Great Neck, L. I., has taken up new duties as a Graduate Fellow at Purdue University where he also serves as Research Associate and Consultant to the Industrial Institute.

He is engaged in the capacity of Consultant to the Industrial Hygiene Division, U. S. Public Health Service and similarly serves private industrial organizations.

Dr. Feinberg is a member of the Committee on Industrial Vision, American Optometric Association. In the American Academy of Optometry he is Chairman of the Speakers Bureau and a member of the Research Committee. He is also a member of the New York Academy of Optometry, American Society of Safety Engineers, Illuminating Engineering Society, and the American Association for the Advancement of Science.

His new address is: Biology Annex, Purdue University, West Lafayette, Ind.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

1. OCULAR REFRACTION

POSTURE ASTHENOPIA. R. Luskin, Columbia Optometrist, 1945, 19, September, 2.

Luskin finds that certain ocular symptoms arise from faulty head posture. These patients lower the head and as a rule keep it in this lowered position for considerable periods of time. This has the same effect as raising the eyes and attempting at the same time to do all necessary visual tasks with them in this abnormal position. Luskin finds that

many of these patients get relief from their symptoms when they are taught to hold the head erect and thus use the eyes in their more normal position in the orbits. C. C. K.

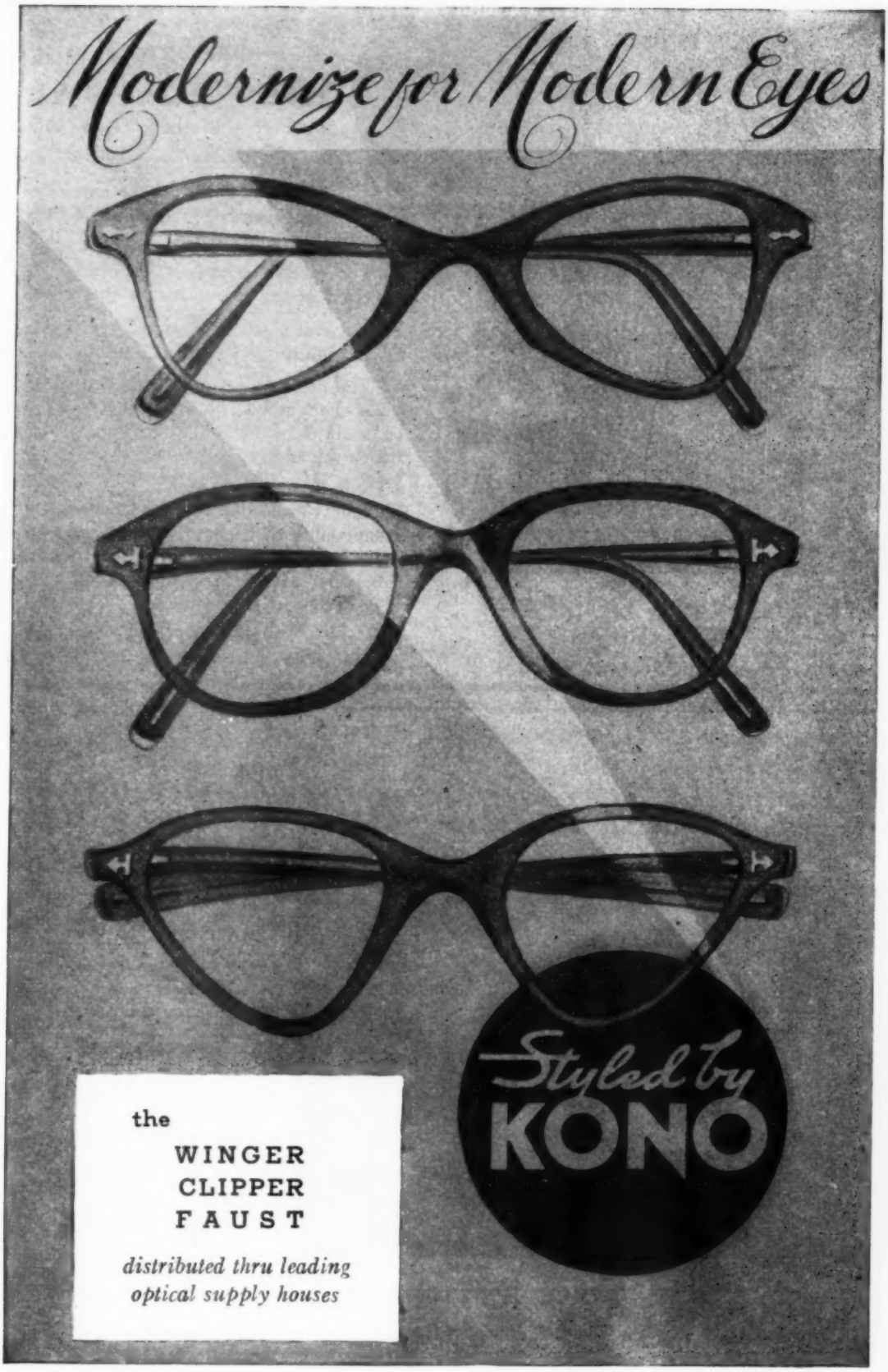
ANISEIKONIA—A REVIEW OF CLINICAL RESULTS. R. Bannon, Optometric Weekly, 1945, 36, 37, 1025-1026.

Bannon reviews some of the work done in correcting aniseikonia. During the past ten years more than 2,600 aniseikonic corrections have been prescribed by the Dartmouth Eye Institute. Questionnaires have been sent to these patients requesting progress reports. Based upon the statements from these patients between 55 per cent and 78 per cent of these corrections gave the patients full or partial relief from the symptoms which brought them to Hanover for a visual examination.

C. C. K.

TO MOLD OR NOT TO MOLD IN CONTACT LENS FITTING. Samuel W. Silverstein, Optical Journal and Review of Optometry, 1945, 82, 23, 25.

After using various techniques in fitting contact lenses, Silverstein comes to the conclusion that making a mold of the eye is both unnecessary and undesirable. He finds (1) that either with or without an anesthesia, the taking of a mold causes some discomfort to the patient. (2) That there are too many variables which enter into taking the mold. (3) That a lack of precision exists in the stone impression, and (4) that much time is lost in working with the semi-finished lenses. He suggests optometrists use the stock lenses in average cases. C. C. K.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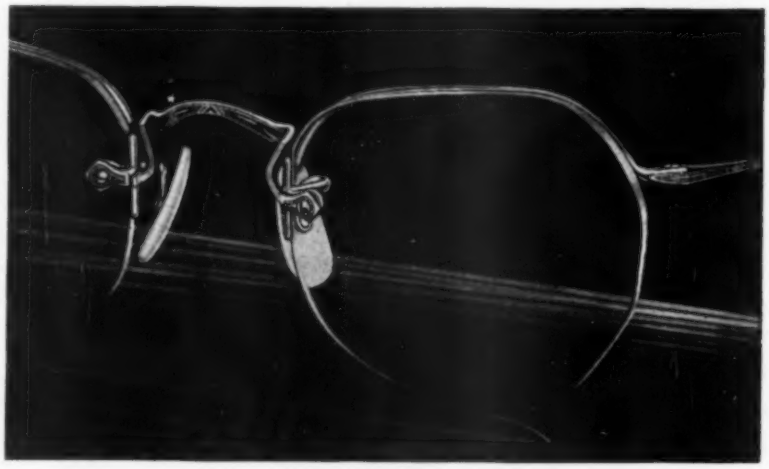

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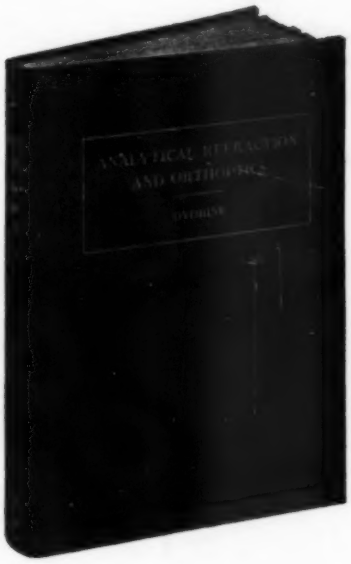

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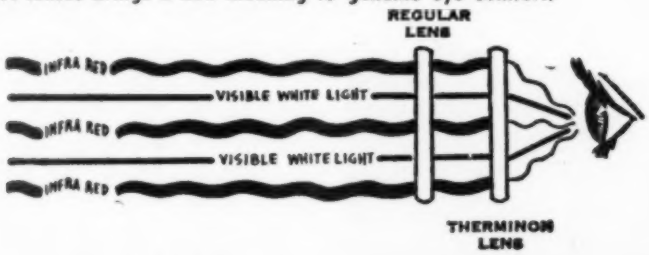

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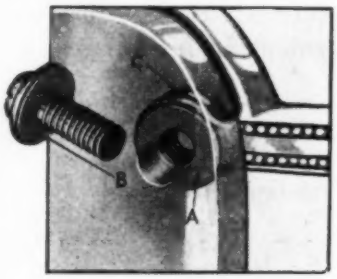

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Cincinnati	March 24th, 25th, 26th	March 27th, 28th, 29th
New York	March 24th, 25th, 26th	March 27th, 28th, 29th
Boston	April 7th, 8th, 9th	April 10th, 11th, 12th

The original instruction schedule in the left hand column above was recently announced and immediately filled. In order to take care of the over-registration, the additional schedule in the right hand column above has been established. There was also an excess registration at Omaha and St. Louis, but an instructor is not now available to give these additional courses.

Future instruction courses will be announced in these pages as they are scheduled. Both theory and clinical practice are covered in the course, the fee for which is $75.00.

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